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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 02/10/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/941,356	Applicant(s) LAI ET AL.
	Examiner Lynette T. Umez-Eronini	Art Unit 1765
-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --		

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on _____.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-24 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) Interview Summary (PTO-413) Paper No(s) _____.
5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____

DETAILED ACTION

Claim Objections

1. Claim 6 is objected to because of the following informalities: " $\text{Si}(\text{CH}_3)_x\text{O}_{2-x}$ " is incorrectly written. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Weber (US 5,505,416).

Weber teaches hydrochloric acid and hydrofluoric acid tend to preferentially etch the interface region between a metal electrode and a substrate such as polyimide (low dielectric constant material), (column 4, lines 21-24), which reads on etching a low dielectric constant material in an aqueous solution of hydrofluoric acid and hydrochloric acid.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber ('416) as applied to claim 1 above, and further in view of Asam (US 4,199,337).

Weber differs in failing to teach the weight ratio of hydrofluoric acid to hydrochloric acid in the solution ranges from 1:3 to 4:1 and 1:1 to 5:1, respectively **in claims 2 and 5.**

Asam teaches, "The etching step may be controlled with precision by regulating the etchant concentration . . ." (column 5, lines 50-52).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Weber by regulating the etchant concentration (same as applicant's the weight ratio) as taught by Asam, which has provided evidence that the etchant concentration (weight ratio) is a so-called "result effective variable," since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272, 206 USPQ 215 (CCPA 1980).

6. Claims 3, 4, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber ('416) as applied to claim 1 above, and further in view of Tobben et al. (US 5,977,635).

Weber differs in failing to teach the low dielectric constant material includes OR groups wherein R is a hydrocarbon derivative, **in claim 3**; methoxy groups, **in claim 4**; and Si(CH₃)_xO_{2-x}, **in claim 7**.

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Tobben teaches a low dielectric constant material such as methyl silsesquioxane (same as $\text{CH}_3\text{SiO}_{1.5}$), polyimides or the like (column 5, lines 51-55).

It is the examiner's position that it would have been obvious to modify Weber by using a low dielectric constant material such methyl silsesquioxane, which includes OR groups wherein R is a hydrocarbon derivative; a methoxy group; and $\text{Si}(\text{CH}_3)_x\text{O}_{2-x}$ as taught by Tobben for the purpose of improving the performance of the multi-level conductive structures by reducing the capacitive coupling among conductive lines and plugs (Tobben, column 2, lines 59-63).

7. Claims 8, 12, 13, 14, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski (US 6,078,088) in view of Weber ('416), and further in view of Lee et al. (US 6,251,752 B1).

Buynoski teaches providing a semiconductor device having at least two metal interconnect layers and a low dielectric constant material between the metal interconnect layer (column 5, lines 45-59 and FIGS. 1-4).

Buynoski differs in failing to teach etching the device with HF and HCl.

Weber teaches a hydrochloric acid and hydrofluoric acid tend to preferentially etch the interface region between a metal electrode and a substrate such as polyimide (low dielectric constant material), (column 4, lines 21-24), which reads on etching a semiconductor device in an aqueous solution of hydrofluoric acid and hydrochloric acid.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski by using Weber's method of etching the device with HF and HCl for the purpose of not degrading or destroying the amorphous silicon device (Weber, column 4, lines 1-6).

Buynoski in view of Weber differs in failing to teach analyzing the etch device in a scan electron microscope.

Lee teaches a structure (electronic) is then etched in a wet etchant such that it may be observed in SEM for studying the characteristic feature or defect and its reason for being defective (column 2, lines 52-54).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber by using Lee's method of analyzing an etched device for the purpose of revealing the characteristic feature and defects of a structure (Lee, lines 52-54).

Buynoski further teaches using various metals for the interconnection system, such as aluminum and copper (column 6, lines 13-15), which respectively reads on,

the metal interconnect comprises aluminum, **in claim 13** and the metal interconnect consists essentially of copper, **in claim 12**.

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8. Claims 9 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('416), and Lee ('752 B1) as applied to claim 8 above, and further in view of Asam (US 4,199,337).

Buynoski in view of Weber, and Lee differs in failing to teach the weight ratio of hydrofluoric acid to hydrochloric acid in the solution ranges from 1:3 to 4:1 and 1:1 to 5:1, **in claims 9 and 17.**

Asam teaches the etching step may be controlled by regulating the etchant concentration (column 5, liens 50-52).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber and Lee by regulating the etchant concentration (same as applicant's the weight ratio) as taught by Asam, which has provided evidence that the etchant concentration (weight ratio) is a so-called "result effective variable," since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272, 206 USPQ 215 (CCPA 1980).

9. Claims 10, 11, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber (416), and Lee ('752 B1) as applied to claim 8 above, and further in view of Tobben ('635).

Buynoski in view of Weber and Lee differs in failing to teach the low dielectric constant material includes OR groups wherein R is a hydrocarbon derivative, **in claim**

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10 and methoxy groups, **in claim 11**; and wherein the low dielectric constant material comprises an organosilicon, **in claim 19**.

Tobben teaches a low dielectric constant material such as methyl silsesquioxane (same as $\text{CH}_3\text{SiO}_{1.5}$), (column 5, lines 51-55), which include an OCH_3 (the same as an OR group where R is a hydrocarbon derivative) and which is an organosilicon.

It is the examiner's position that it would have been obvious to modify Buynoski, in view of Weber, and Lee by using a low dielectric constant material such methyl silsesquioxane, which includes OR groups wherein R is a hydrocarbon derivative; a methoxy group; $\text{Si}(\text{CH}_3)_x\text{O}_{2-x}$ and comprises as organosilicon, as taught by Tobben for the purpose of improving the multi-level conductive structures that reduce the capacitive coupling among their various conductive lines and plugs in order to improve performance (Tobben, column 2, lines 59-63).

10. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber (416), and Lee ('752 B1) as applied to claim 8 above, and further in view of Gardner (US 6,080,640).

Buynoski in view of Weber, and Lee differs in failing to teach the low dielectric constant material has a dielectric constant less than 3.8, as **in claim 15** and comprises fluorosilicate, **in claim 16**

Gardner teaches, "Examples of low K dielectric material may be . . . one of the following materials: fluorosilicate glass (FSG), silicon oxyfluoride, hydrogen silsesquioxane, fluorinated polysilicon, poly-phenylquinoxaline, polyquonoline,

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methylsilsesquixane polymer, and fluoro-polymide. Those materials listed above which contain fluorine typically have a K value ranging from approximately 3.0 to 3.8. The polymer-based materials listed above typically have a K value ranging from approximately 2.0 to 3.5, " (column 5, lines 44-67), which reads on,

the low dielectric constant material has a dielectric constant less than 3.8 and comprises fluorosilicate.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber, and Lee by using a low dielectric constant material of less than 3.8 and comprising fluorosilicate glass as taught by Gardner for the purpose of minimizing the capacitative effects, which assists in improving the operation speed of the device (Gardner, column 8, lines 38-49).

11. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('301),

Buynoski teaches providing a semiconductor device having at least two metal interconnect layers and a low dielectric constant material between the metal interconnect layer (column 5, lines 45-59 and FIGS. 1-4).

Buynoski differs in failing to teach etching the device with HF and HCl.

Weber teaches a hydrochloric acid and hydrofluoric acid tend to preferentially etch the interface region between a metal electrode and a substrate such as polyimide (low dielectric constant material), (column 4, lines 21-24), which reads on etching a

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semiconductor device in an aqueous solution of hydrofluoric acid and hydrochloric acid.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski by using Weber's method of etching the device with HF and HCl for the purpose of not degrading or destroying the amorphous silicon device (Weber, column 4, lines 1-6).

12. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber (416), as applied to claim 21 above, and further in view of Tobben ('635).

Buynoski in view of Weber differs in failing to teach the low dielectric constant material is formed from an organosilicon.

Tobben teaches a low dielectric constant material such as methyl silsesquioxane (same as $\text{CH}_3\text{SiO}_{1.5}$), (column 5, lines 51-55), which reads on a low dielectric constant material is formed form an organosilicon.

It is the examiner's position that it would have been obvious to modify Buynoski in view of Weber by using a low dielectric constant material such methyl silsesquioxane as taught by Tobben for purpose of improving the multi-level conductive structures that reduce the capacitive coupling among their various conductive lines and plugs in order to improve performance (Tobben, column 2, lines 59-63).

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13. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buynoski ('088) in view of Weber ('416) as applied to claim 21 above, and further in view of Asam (US 4,199,337).

Buynoski in view of Weber differs in failing to teach the weight ratio of hydrofluoric acid to hydrochloric acid in the solution ranges from 1:3 to 4:1, **in claim 23** and the weight ratio of deionized water to either the HF or HCl ranges from 20:1 to 6.5, 1:1 to 5:1, **in claim 24.**

Asam teaches the etching step may be controlled by regulating the etchant concentration (column 5, lines 50-52).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Buynoski in view of Weber by regulating the etchant concentration (same as applicant's the weight ratio) as taught by Asam, which has provided evidence that the etchant concentration (weight ratio) is a so-called "result effective variable," since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 f.2d 272, 206 USPQ 215 (CCPA 1980).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703-308-3836. The fax phone numbers

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for the organization where this application or proceeding is assigned are 703-972-9310
for regular communications and 703-972-9311 for After Final communications.

Itue
February 3, 2003

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